

SOV/76-33-8-27/39

Redox Potentials of Dithiophosphates

pentasulphide (Ref 9). For the determination of the (RP) of the dithiophosphates (DP), two methods were used - a determination of the equilibrium constant of the oxidation reaction of the (DP) with iodine, and a measurement of the (RP) by the compensation method. The results furnished by the former method for an initial concentration of the (DP) of $1.85 \cdot 10^{-3}$ g.mol/l are given (Table 1); as well as those obtained by the potentiometrical measurements of various (DP) (Table 2). In order to determine the accuracy of determination, the standard potential was calculated by means of an equation (4) for dihexyldithiophosphate and compared with the experimental data (Table 3). The reversibility of the oxidation process of the (DP) with iodine was found, and the standard (RP) of alkyl dithiophosphates was determined for systems in which liquid disulphide was regarded as standard state. The effect of the length of the hydrocarbon chain of the (DP) radicals upon the magnitude of the (RP) was examined, and an appropriate equation given for calculating the (RP) as a function of the carbon number of the radical. The influence of the iso-structure of the apolar group of the (DP) upon the magnitude of the (RP) was also found. Furthermore, the solubility of

Card 2/3

Redox Potentials of Dithiophosphates

SOV/76-33-8-27/39

dimethyldithiophosphate disulphide in water was determined at 25°C and a formula for the calculation of the solubility of disulphides and other (DP) was suggested. The standard (RP) of the homologous (DP) series for the standard state (disulphide solution in water) was calculated with an activity = 1. There are 1 figure, 3 tables, and 19 references, 16 of which are Soviet.

ASSOCIATION: Ural'skiy politekhnicheskii institut im. S. M. Kirova
(Urals Polytechnic Institute imeni S. M. Kirov)

SUBMITTED: February 11, 1958

Card 3/3

AVSARAGOV, B.G.; NAGIRNYAK, F.I.; STEPANOV, B.A.

Ways to increase the complete utilization of copper and copper-zinc
pyrites of the Southern Urals. TSvet. mat. 34 no. 4:1-3 Ap '61.
(MIRA 14:4)

(Ural Mountains—Pyrites)

KLEBANOV, O.B.; SKROBOVA, A.V.; STEPANOV, B.A.

Using residues of electrolytic zinc plants for copper deposition
in the concentration of oxidized copper ores on a combined flow-
sheet. TSvet. met. 35 no.11:36-37 N '62. (MIRA 15:11)
(Copper--Electrometallurgy)

CHAKHOTIN, V.S.; UDALOV, L.K.; STEPANOV, B.A.

Use of natural gas at the Almalyk copper smelting plant. TSvet.
met. 35 no.11:49-51 N '62. (MIRA 15:11)
(Almalyk--Copper--Metallurgy)

KLEBANOV, O.B.; NESTEROV, V.G.; STEPANOV, B.A.; KORESHKOV, G.Z.

Using the original ore to reduce an excess of reagents in
flotation. Obog. rud. 8 no.2:5-6 '63. (MIRA 17:2)

ZUBKOV, A.A.; STEPANOV, B.A.; CHERDYNTSEV, I.Ye.

Draining of copper cement concentrates. Izv. AN Uz. SSR. Ser.
tekhn. nauk 8 no.5:75-77 '64. (MIRA 18:2)

1. Sredneaziatskiy filial Gosudarstvennogo nauchno-issledovatel'skogo instituta tsvetnykh metallov.

NESTEROV, V.G.; STEPANOV, B.A.

Investigating the description of butyl xanthate from galenite
by waste minerals during flotation. Izv. AN Uz. SSR. Ser.
tekh. nauk 9 no. 1:85-87 '65 (MIRA 19:1)

1. Submitted March 25, 1964.

STEPANOV, B.A.; IVANOV, V.I.; GOLOMZIK, A.I.; NAGIRNYAK, F.I.

Microbiological leaching of sulfide ores. Fiz.-tekhn. probl.
razrab. pol. iskop. no.4:118-121 '65. (MIRA 19:1)

1. Politekhnikheskiy institut, Tashkent. Submitted March 2, 1965.

STEPANOV, B.A.; FOMINYKH, B.A.; GAREYEV, V.N.

Series of metal stresses in the solutions of alkali sulfides.
Izv.AN Uz.SSR.Ser.tekh.nauk 9 no.5:75-77 '65.

(MIRA 18:10)

1. Sredazniprotsvetmet.

STEPANOV, B.D.

Organizativakh Proizvodstva Na
Nyasntkh Predprivatnyakh. Organization of production for the Meat Enterprise
Moskva, Pishcheprohitdat, 1946
158 p. illus., Graphs

STEPANOV, B.D.

[Organization and planning for enterprises of the meat industry]
Organizatsiia i planirovanie predpriatii miasnoi promyshlennosti.
Moskva, Pishchepromizdat, 1955. 330 p. (MLRA 10:1)
(Meat industry)

STEPANOV, B. kandidat tekhnicheskikh nauk.

Planning of organizational and technical measures. Mias. ind.
SSSR no.2:35-36 '57. (MLRA 10:5)
(Meat industry)

STEPANOV, B., inzh.

Administration of packing houses without sections. Mias. ind. SSSR
29 no.2:45-46 '58. (MIRA 11:5)
(Packing houses)

STEPANOV, B., dotsent

"Science **Day.**" Mias.ind.SSSR 30 no.6:22 '59. (MIRA 13:4)
(Meat industry)

STEPANOV, Boris Dmitriyevich; DONSKOV, V.Ye., spets. red.; MOISEYEV, P.N.,
spets. red.; NOZDRINA, V.A., red.; KISINA, Ye.I., tekhn. red.

[Production organization and planning in enterprises of the
meat industry] Organizatsiya i planirovaniye proizvodstva na
predpriyatiyakh miasnoi promyshlennosti. Moskva, Pishchepromizdat,
1960. 383 p. (MIRA 14:5)

(Meat industry)

SURKOV, V.D.; STEPANOV, B.D.

Strengthening the creative collaboration of science and industry.
Izv.vys.ucheb.zav.; pishch.tekh.no.5:175-176 '60. (MIRA 13:12)
(Science) (Food industry)

STEPANOV, B.G.; ZAKHARCHENKO, B.F.; BEZEL', V.S.

On rotating plasma. Zhur.eksp. i teor. fiz. 34 no.2:512-513 P '58.
(MIRA 11:4)

1. Ural'skiy politekhnicheskiy institut.
(Gases, Ionized) (Magnetohydrodynamics)
(Electric discharges through gases)

AT 6036573

SOURCE CODE: UR/0000/66/000/000/0188/0189

41

AUTHOR: Kalinina, A. N.; Stepanov, B. G.; Shugam, Ye. I.

ORG: none

TITLE: Visual image recognition and visual determination of the degree of similarity between images [Paper presented at the Conference on Problems of Space Medicine held in Moscow from 24 to 27 May 1966]

SOURCE: Konferentsiya po problemam kosmicheskoy meditsiny, 1966. Problemy kosmicheskoy meditsiny. (Problems of space medicine); materialy konferentsii, Moscow, 1966, 188-189

TOPIC TAGS: vision, pattern recognition, space psychology, visual test

ABSTRACT: In previous experiments, one of the authors, using a special electronic assembly, observed an artificially retarded process of pattern recognition. Based on this observation, a description of the characteristic peculiarities of two approaches to recognition was given: The use of one yields a small number of errors but is characterized by the retardation of the recognition process; the use of the second is characterized by more rapid recognition but a higher number of errors. After analyzing the experimental data, it was proposed that under certain reception conditions, the speed of recognition prevailed with no substantial loss of accuracy.

The verification of this observation was one of the purposes of the present investigations. Another aim was to reveal the nature of

Card 1/3

L 10954-67

ACC NR: AT6036573

connection between recognition¹ and the similarity of certain patterns.

Simple, contour patterns were used. The contour was broken down into portions of equal length. By erasing various portions, lined patterns containing various amounts of information were derived. The position of the lines was arranged using a table of random numbers. The patterns were arranged in three groups according to the amount of information. The pattern presentation proceeded from a small to a large amount of information. The order of presentation within groups was random and uniform for all subjects.

Two series of experiments were conducted. First, tests for recognition of graphic patterns were conducted. Here the two methods of recognition were revealed and it was demonstrated that the second method had the advantage of higher speed and quantity of test objects to be recognized for the majority of patterns in a given class.

To solve the problem of the link between recognition and similarity, a second series of experiments was conducted in which the similarity of a pattern to its standard was measured. It was necessary to compose a series with progressive similarity, i.e., each subsequent

Card 2/3

ACC NR: AT6036573

pattern had to be more similar than the preceding to its standard. A number was assigned to each pattern. The distribution of numbers assigned to a given pattern by various subjects was constructed and the mathematical prediction and dispersion of distributions was calculated. Later, the mathematical prediction was used to evaluate the degree of pattern similarity with its standard. After processing these results, it was possible to isolate 9 of 20 patterns in each series which significantly differed from the standard.

Experimental verification of these patterns according to the same scheme used in a preceding test showed that of ten subjects, eight assigned a given pattern the same number and that the distribution of pattern numbers in the abridged and unabridged series was identical. [W.A. No. 22; ATD Report 66-116]

SUB CODE: 06 / SUBM DATE: 00May66

Card 3/3¹³

L 12069-66 EWT(1)/T/EWP(k)/EWA(h) IJP(c) AT

ACC NR: AP5021483

SOURCE CODE: UR/0046/65/011/003/0398/0399

AUTHOR: ^{44 55} Ivanov, S. N.; ^{44 55} Skvortsova, N. Ye.; ^{44 55} Stepanov, B. G. ⁶⁹

ORG: Institute of Radio Engineering and Electronics AN SSSR (Institut radiotekhniki i elektroniki AN SSSR)

TITLE: Investigation of GaAs p-n junctions operating as converters of ultrasonic oscillations into electric oscillations ^{21, 44, 55}

SOURCE: Akusticheskiy zhurnal, v. 11, no. 3, 1965, 398-399

TOPIC TAGS: gallium arsenide, semiconductor diode, pn junction, acoustoelectric transducer, ultrasonics, frequency dependence

ABSTRACT: The authors investigated the performance of GaAs diodes to determine the effect of the geometric dimensions of the base on the efficiency of such a diode as an ultrasonic transducer. This influence can be investigated by varying in definite fashion the relation between the thickness of the base and the wavelength of the applied ultrasonic oscillations, and observing the frequency dependence of the conversion efficiency. The measurements were made at frequencies for which the wavelength was approximately equal to the base thickness. The diodes were prepared by diffusion of zinc in n-type GaAs plates and tested by applying rectangular ultrasonic pulses to the investigated diode through an ultrasonic delay line (Fig. 1). The output-signal voltage was found to exhibit a definite dependence on the frequency of the ultrasonic oscillations. The transformed signal had a maximum when the thickness d of the diode

Card 1/2

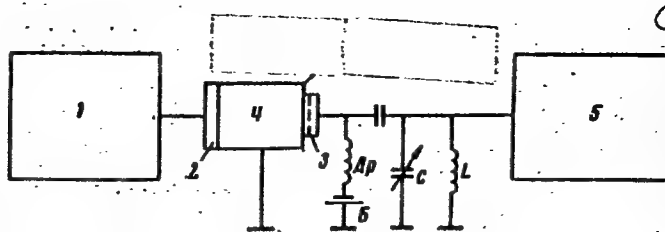
UDC: 534.232

L 12069-66

ACC NR: AP5021483

Fig. 1. Diagram of test setup.

1 - Pulse generator, 2 - quartz plate, 3 - tested diode, 4 - delay line (10 microseconds), 5 - oscilloscope



base region was connected with the wavelength λ by the relation $d \approx \lambda(2n + 1)/4$ ($n = 0, 1, 2, \dots$). In the experiments d was equal to 1.7×10^{-1} cm, making it possible to observe in the 7--14 Mcs range up to six frequencies corresponding to the maximum of the converted signal. This relation is similar to that of a compound vibrator, and it is shown on the basis of several other properties that the model of the compound vibrator can be used for the analysis of the performance of an electro-acoustic diode transducer. The conversion efficiency depends on the choice of the geometrical dimensions of the diode. Orig. art. has: 2 figures and 5 formulas.

SUB CODE: 20/ SUBM DATE: 06Jul64/ ORIG REF: 001/ OTH REF: 006

60
Card 2/2

MECHANICAL, P. 1.

Mechanical Engineering

Designing spatial transmission mechanisms with lower pairs. Izv. Akad. nauch. tekh. nauch., 12, No. 15, 1951.

9. Monthly List of Russian Accessions, Library of Congress, June 1951, Uncl.
2

STEPANOV, B.I., dotsent; BOKOV, V.N., dotsent, red.

[Lectures in the course of machine parts; brief information on interchangeability, tolerances, and fits.] Lektsii po kursu detalei mashin; kratkie svedeniia po vzaimozameniamosti, dopuskam i posadkam. Moskva, M-vo vysshago obrazovaniia SSSR. Vses.zaochnyi energ.in-t, 1959. 40 p. (MIRA 13:3)
(Mechanical engineering--Study and teaching)

A 53
J

SA

4996. Fine Structure of the Metastable Level of Nitrogen.
B. Stepmann. *Phys. Zeits. d. Sowjetunion* 8, 2, pp. 342-353, 1934. In
German.—A record of some spectrographic observations. The values
found for the magnitude of the splitting of the lines 1742-740 Å and
1745-260 Å are 2·10 cm.⁻¹ and 2·13 cm.⁻¹. J. J. S.

MATERIALS INDEX

ASB-SLA METALLURGICAL LITERATURE CLASSIFICATION

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U.S. NATIONAL BUREAU OF STANDARDS

The fourth positive band group of carbon monoxide in the Schumann region. V. M. Chulanovskii and H. A. Stepanov. *Fizika i Sovetskoye* 10, 362-314 (1930). *Dokl. Akad. Nauk SSSR*, 1931, 2.

The bands (3,0), (3,7), (3,8) (2,7), (2,0), (1,0) and (1,5) of the fourth pos. CO group have been analyzed. The rotational const. of the levels $N''=4$ and $A''=1$, which have been detd. by other authors, have been checked and improved. In all of the bands, perturbations were observed and investigated. The method of detg. the rotational consts. of the perturbed triplet term has been improved somewhat. Complete tables of the bands are given. Harold Gershwinowitz

1ST AND 2ND COLUMNS		PROCESSES AND PROPERTIES INDEX		3RD AND 4TH COLUMNS	
BC				A-1	
<p>Dependence of predissociation limit on rotational energy. M. ELZASHEVITSON and B. SHYFANOV (Physical Z. Sovietunion, 1958, 10, 703-710).—Theoretical. The dependence of the predissociation limit on the rotational quantum no. J for different types of predissociation is considered. The conditions under which predissociation limits may be found in successive vibrational levels are discussed. The special case where only the low vibrational levels are predissociated can occur, but is rare. A. J. M.</p>					
<p>ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION</p>					
1ST COLUMN		2ND COLUMN		3RD COLUMN	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100		1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	

Investigation of the interaction of various components of level $^2\Sigma$ with level 4H . B. I. Stepanov. J. Phys. (U.S.S.R.) 2, 81-8 (1940) (in English).--The form of the matrix elements of interaction between 4H and $^2\Sigma$ levels was investigated and formulas suitable for different orientations of the spin of the 2 outer electrons of the 4H level are given. The theoretical results were tested on perturbations of the level $v = 0$ of the 4H mol. The formula for matrix elements deduced by Hudec and Kovacs (C. A. 32, 7520) from the assumption that the spins in the 4H level are orientated along the axis of the mol. is believed to be wrong. It is further shown by calcn. that the spins are not oriented in the direction of the K vector. It is finally assumed that the conception of a case of intermediary coupling introduced for 4H and 4I levels is also applicable to the 4H level. E. Gouet.

Lab. 7 Molecular and Atomic Spectroscopy,
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CP

111 AND 110 ORDERS

PROCESSES AND PROPERTIES INDEX

3

COMMON VARIANTS INDEX

Shape of perturbation curves for the intersection of levels $^2\Sigma$ and $^2\Pi$ of the diatomic molecule. B. I. Stepanov. *J. Phys. (U. S. S. R.)* 2, 89 95(1940)(in English).--It is shown, with the perturbation of the simple level $v = 0$ A Π of the CO mol. as an example, that the approximation given by Kovács and Rudó (cf. C. A. 32, 7820) for the intersection of the $^2\Pi$ and $^2\Sigma$ levels does not always hold, owing to the intersection with the triplet level $^4\Sigma^-$. At the point of intersection of 2 levels the distorting effect of a third one has to be considered. A method is also developed for an approx. solution of the secular determinant of the third order applicable in practically any case. It is finally shown that the necessity of taking into account a third interacting level greatly hampers the computation of the const. of the $^2\Sigma$ level.

Frank Gonet

Lab. of Molecular and Atomic Spectroscopy, State Optical Inst., Leningrad

ASB-51A METALLURGICAL LITERATURE CLASSIFICATION

111 AND 110 ORDERS

COMMON VARIANTS INDEX

3

CA

Calculation of constants of the level $b^2\Sigma$ in molecule CO.
 B. I. Stepanov. *J. Phys. (U. S. S. R.)* 2, 107 (1940) (in English); cf. *C. A.* 34, 8340. Theoretical-math. Gero's method for calcg. the rotational const. B is not applicable when the perturbations are closely spaced. A more-accurate method of calcn. is given. For the vibrational levels $v = 0$ and $v = 1$ of the $b^2\Sigma$ state of the CO mol. the const. were calcd. and found to be $B_0 = 1.905$, $v = 0$ (42), $B_1 = 1.923$, $\omega_e = 2180$, $A_0 = 83.816$. These values for B_0 and ω_e are in good agreement with the energy scheme of Chulanovskii (*C. A.* 33, 2902). Interaction of the level $b^2\Sigma$ with the high vibrational levels of the triplet state $a^2\Sigma$ in the molecule CO. B. I. Stepanov. *Ibid.* 205-12. The interaction of the $b^2\Sigma$ and $a^2\Sigma$ states was investigated. By Gero's method the values of B for the vibrational states $v = 31$ and $v = 36$ of the perturbing level $a^2\Sigma$ are: $B_{31} = 0.800$, $B_{36} = 0.711$. The reason for the relatively great intensity of the $a^2\Sigma \rightarrow b^2\Sigma$ bands due to the T_{31} and T_{36} levels is to be found in perturbation.
 F. H. Rathmann

STEPANOV, B. I.

"On the Interaction of the Level $b^3\Sigma$ with the High Vibrational Levels of the Triplet State at $^3\Sigma$ in the Molecule CO," Zhur. Fiz., Vol.2, No.3, p. 205, 1940.

Lab. of Molecular and Atomic Spectroscopy, State Optical Inst., Leningrad.

C A

The interaction of the potential curves of a diatomic molecule. B. I. Stepanov. *J. Phys.* (U. S. S. R.) 2, 373-64 (1940) (in English).—Theoretical-math. The resonance interaction of potential curves is investigated. The phys. meaning of this interaction and its connection with the ordinary resonance perturbation of rotational levels and with the so-called vibrational perturbation have been ascertained. F. H. Rathmann

3

Exact shape of perturbation curves for the interaction of the $^1\Pi$ and $^2\Sigma$ levels of the CN molecule. H. I. Stepanov. *J. Phys. (U. S. S. R.)* 2, 377-80(1960)(in-English).—

Using exptl. data of Jenkins, Rosenthal, Roots and Mulliken, H. plots completely the resonance perturbation of the levels $X^1\Pi$, $v = 11$ and $A^1\Pi$, $v = 0$ of the CN mol. The shape of the curves is in perfect accord with Kronig's theory. Shapes of perturbation curves for the resonance interaction of the $^1\Pi$ and $^2\Sigma$ levels of a diatomic molecule. *Ibid.* 381-5; cf. C. A. 34, 5340. —Lutman's approximation (C. A. 28, 30; 27, 4734), in which only the mutual influence of two levels in each of the four points of intersection was considered, for the resonance perturbation of mols. such as CO^+ , N_2^+ , CN and hydrides, is rather unsatisfactory. P. H. Rathmann

PROCESSES AND PROPERTIES INDEX																									
Perturbations near the predissociation limit. H. I. Stepanov. <i>J. Phys. (U. S. S. R.)</i> 3, 363-8(1940) (German).—Interaction between discrete and continuous levels of a diat. mol. is considered. The results are in agreement with observed perturbations in the spectra of CaII, N ₂ , S ₂ and Se ₂ . G. M. Murphy																									
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3

Perturbations in molecular spectra. B. I. Stepanov. *Bull. acad. sci. U. R. S. S., Ser. phys.* 4, 65-8(1940); cf. *C. A.* 36, 6340⁹.—Several cases of perturbation in the spectra of diatomic mols. were investigated. For the case of interaction between a given level and the neighboring vibrational levels, a method for the calcul. of the rotational const. is developed. This method is applied to the mols. CO, BaH and CaD. For CO mols. the perturbations of the vibrational levels were studied. Roksalana Gamow

12. Ak. Nauk SSSR,
Ser. Fiz.

ASD-SEA DETAILING LITERATURE CLASSIFICATION

SIKAROV, D. I.

Leningrad

Laboratory of Molecular Spectroscopy, State Optical Institute, (-1940-).

"The Oscillatory Spectra of Hydrocarbon Molecules." Part II. "The Frequencies of Valence Oscillations of a Carbon Chain of Molecules of the Paraffin Series."

Zhur. Fiz. Khim., Vol. 14, No. 4, 1940.

PROCESSED AND PROPERTY INDEX																																																																																																							
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<p>CA</p> <p>Resonance perturbations in the spectra of diatomic molecules. B. I. Stepanov. <i>J. Phys. (U. S. S. R.)</i> 4, 111 (1941); <i>Science Abstracts</i> 45A, 11(1942); cf. C. I. 35, 2970; 36, 1289. The resonance interaction of levels $4l \times 4l$, $4l \times 4l$, $4l \times 4l$, $4l \times 4l$ of the d_{odd} and are considered. Formulas are derived for the matrix elements of interaction, and perturbation curves are plotted. Tables are compiled to show the resonance interaction of levels of any multiplicity. C. I. B.</p> <p><i>Zh. fiz.</i> 3</p>																																																																																																							
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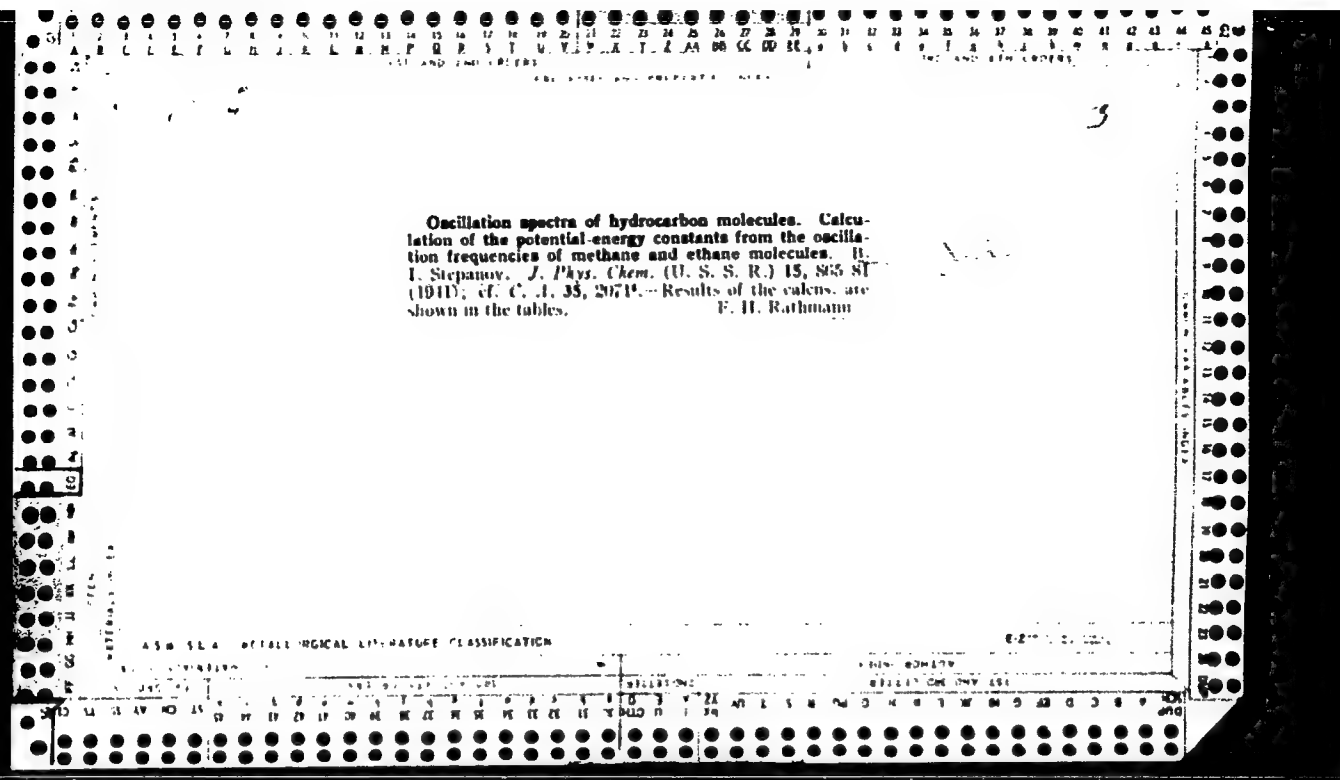
Calculation of the frequencies of polyatomic molecules. M. A. Elashkevitch and B. I. Stepanov (*Dokl. Akad. Nauk SSSR, Ser. Fiz.*, 1941, **6**, 155-157). A method is indicated for calculating the vibration frequencies of polyat. mols. Application of the method to CH_4 , C_2H_2 , and C_2H_4 is successful. | 11

*12. Ak. Nauk SSSR,
Ser. Fiz.*

Vibration spectra of hydrocarbon molecules. V. Calculation of the frequency of valence oscillations of carbon chains of the olefinic series. B. I. Stepanov. *J. Phys. Chem.* (U. S. S. R.) 19, 78 (1941). Using an equation derived by El'yashevich (*C. A.* 35, 2071) S. rules, the oscillation frequencies of the hydrocarbon chains of the simple olefins. It is shown that the characteristic frequency of the double bond is a function of the nature and no. of the neighboring bonds but is independent of the degree of branching of all further-removed parts of the mol. The difference between the observed and the calcd. frequencies is about 6 cm.⁻¹ in straight-chain compounds and increases to 12 cm.⁻¹ for doubly branched olefins. F. H. Rathmann

Zhm-Fiz. Khim.

ASD 514 DETAILORICAL LITERATURE CLASSIFICATION



SA

1316

535.338.42 : 547.213/214

Interpretation of vibrational spectra of propane and butane. ELIASHEVICH, M., AND STEPANY, B. C.R. (Doklady) Acad. Sci. U.R.S.S. 32, 7, pp. 481-483, 1911.—Describes an application of the general method for the calculation of vibrational frequencies of polyatomic molecules, given in an earlier paper (27, p. 604, 1940). Calculations were made for methane and ethane and their deuterium derivatives, and compared with experimental values. The frequencies of propane and butane were calculated with the aid of the known set of force constants. Good agreement with experimental values was obtained, leading to a definite identification of most frequencies.

A. E. T.

ASS-3LA METALLURGICAL LITERATURE CLASSIFICATION

FROM DIVISION

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A-1

Vibrational spectra of hydrocarbon molecules. IX. Computation of the frequencies of propane and butane. M. A. Eliashkevitch and B. I. Stepanov (*J. Phys. Chem. Russ.*, 1943, 17, 145-159).—Frequencies of C_3H_8 and C_4H_{10} are calc. on the basis of those of CH_4 and C_2H_6 and their heavy analogues. Agreement with observed frequencies is satisfactory.

Yel'yashovich,
Zhm. Fiz. Khim.,

ASR SLA DETALLUPICAL LITERATURE CLASSIFICATION

REGION 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

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<p>BC</p> <p style="text-align: right;">A-1</p> <p style="text-align: center;">Determination of potential energy constants for halogen derivatives of methane. H. I. Stepanov (<i>Compt. rend. Acad. Sci. U.R.S.S.</i>, 1943, 60, 250-262).—The general method for the calculation of vibrational ν of polyat. mols. given by Eliashvitsch (cf. A., 1942, I, 193) has been applied to the complete series of fluoro-, chloro-, and bromo-methanes. A comparison of the vals. obtained is attempted.</p> <p style="text-align: right;">Dokl. AN SSSR.</p> <p>State Optical Inst.</p> <p style="text-align: center;">ASO-SLA METALLURGICAL LITERATURE CLASSIFICATION</p>																																																																																																																																																															
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<div style="display: flex; justify-content: space-between;"> <div style="width: 15%;"> <p>COMMON ELEMENTS</p> <p>OPEN</p> <p>MATERIALS INDEX</p> </div> <div style="width: 70%;"> <p><i>GA</i></p> <p>Spectroscopic method for the determination of the heat of the hydrogen bond. V. I. Malyshev. <i>Bull. acad. sci. U.R.S.S., Ser. phys.</i> 9, 198-200 (1945).—The appearance of band spectra is attributed to complex formation in alcohols due to the "hydrogen bond" in the OH radical. The heat of the bond is calcd. to 13.0 kg.-cal. per mol. from intensity measurements of the spectrum in solns. of CH₃OH in CCl₄ at different temp. S. Pakwer</p> <p>Relations in the spectra of molecules with hydrogen bonds. B. I. Stepanov. <i>Bull. acad. sci. U.R.S.S., Ser. phys.</i> 9, 201-2 (1945).—Theoretical. Formation of bands in liquids with linkages OH...O is explained through discussion of their potential-energy curves. S. P.</p> <p><i>12. Ak. Nauk SSSR, Ser. Fiz.</i></p> </div> <div style="width: 15%;"> <p>CUSTOMER VARIATION INDEX</p> </div> </div>																																																			
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PROCESSES AND PRIORITIES INDEX

2

2 km. Fiz;

Prodisassociation of a system of discrete levels. H. I. Stepanov. J. Phys. (U.S.S.R.) 9, 317-25(1945). Math. By use of a method of calcn. similar to that used by Bate (C.A. 23, 8407; 27, 36679), calcn. of the shape of absorption bands is carried out for the predissocn. of a whole series of closely situated discrete levels, and absorption curves are constructed for a no. of different cases. The dependence of absorption on the magnitude of the matrix element and on the interaction of discrete and continuous levels is considered. The conditions of complete diffusion of the vibrational structure of the spectrum are obtained. Frank Conet

State optical Inst.

ASB-55.6 METALLURGICAL LITERATURE CLASSIFICATION

STEPANOV, B. I.

"The Theory of Vibrational Spectra of Polyatomic Molecules, II. Computation of the Frequencies of Halide Derivatives," Zhur. Eksper. i Teor. Fiz., 15, No. 1-2, 1945.
Lab. of Spectral Analysis, State Optical Inst., Leningrad.

3

Calculation of frequencies and interpretation of vibrational spectra of polyatomic molecules. Methanol. R. L. Stepanov (State Optical Inst.) Phys. Chem. U.S.S.R. 19, 107 (1961) 15; of C.I. 19, 4245. The frequencies of the Raman lines of CH_3OH , CH_3OD , CD_3OH , and CD_3OD are systematized and interpreted. I. J. Bakerman.

2 hrs. File Kham.

ASAC SLA METALLURGICAL LITERATURE CLASSIFICATION

3

GA

PROCESSES AND PROPERTIES INDEX

The theory of hydrogen bond. I. Explanation of the regularities in the spectra of molecules forming hydrogen bonds, by predissociation effects. H. I. Stepanov (State Optical Inst.). *J. Phys. Chem. (U.S.S.R.)* 19, 507 (1915); cf. *C.I.* 40, 521. The spectrum of the H bond is discontinuous as long as the O-H link is in the normal state. When this link is excited, a continuous sequence of energetically unstable states is possible for the H bond. However, only those transitions from a stable to an unstable state are probable which leave unaffected the O atoms in the system O-H-O. On this basis it is possible to explain the diffuse bands due to H bonds in liquids and their shifts due to substitution of D for H and to temp. variations.

Zhm-Fiz Khim.,
I. I. Rikerman

ASB-SLA METALLOGICAL LITERATURE CLASSIFICATION

SEARCHED INDEXED

191 AND 2ND EDITIONS

191 AND 2ND EDITIONS

Calculation of the frequencies of halogen-substituted methane. B. Stepanov, *Acta Physicochim. (U.R.S.S.)* 20, 171 884(1945); *J. Exptl. Theoret. Phys. (U.S.S.R.)* 15, 43 69(1946) (English summary). Frequencies of F, Cl, and Br-substituted methanes are calcd. and compared to observed values. Seventy-nine frequencies are calculated. The form of vibrations and the potential-energy consists of these compounds, are discussed. S. Pakser

Lab Spectral Analysis, State Optical Inst.

B. STEPANOV

[illegible]

"Valence Force and Central Force Models for Molecular Vibrations," Zhur. Fiz., Vol. 10, No.3, pp. 243-51, 1946.

PROCESSES AND PROPERTIES INDEX

The theory of hydrogen bond. Explanation of the regularities in the spectra of molecules forming a hydrogen bond, by the predissociation effect. H. B. I. Stepanov (State Optical Inst., Leningrad). J. Phys. Chem. (U.S.S.R.) 20, 907-15(1946)(in Russian); cf. C.A. 40, 2740^a, 5098^b.—The explanation given previously is put on a quant. basis. The Schrödinger equation for the system OH...O is solved in Jacoby's coordinates and the result accounts for the effect of the H bond on the width and position of spectrum lines at various temps.

J. J. Hickman

Zhm. Fiz. Khim., 3

3

Characteristic frequencies in the spectra of complicated branched paraffins. B. I. Stepanov (State Optical Inst., Leningrad). *J. Phys. Chem. (U.S.S.R.)* 20, 917-28 (1946) (in Russian). The theoretical and exptl. Raman frequencies of normal paraffins are compared with those of branched paraffins. Normal paraffins have the lines 1140 (1) and 1160 (1), the nos. in the parentheses meaning the intensity on an arbitrary scale. Isoparaffins show the lines 1140 (1) and 1170 (1). Paraffins of the $C_n(CH_3)_4$ type have intensive lines in the region 1200-1240. Branching at the end of a chain causes appearance of a frequency near 955. The detn. of the structure of a branched paraffin from its Raman spectrum is illustrated by several examples. J. J. Bikerman

Sensitizing

PA

1085
The Theory of Optical Sensitization. P. V. MEKLYAR and B. I. STEPANOV.
Compt. rend. Acad. Sci. U.R.S.S., 54, 791-794, Dec., 1946.—The luminous
energy absorbed in the region of sensitization is much less than that needed to
bring an activated electron in the silver bromide lattice into the conductivity
zone. It is suggested that the mechanism of sensitization can be explained by
supposing that the additional energy is furnished by the thermal energy of the
dye molecule. Analogous phenomena occurring in the case of fluorescence, the
proposed hypothesis has a physical basis. The suggested treatment also explains
the lowering of the initial sensitivity by sensitizing dyes and the mechanism of
desensitization. K.J.C. (based on S. et I.P.).

771.334.2

Date, AN SSSR,

1947

PROCESSES AND PROPERTIES																									
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<p>4</p> <p>Regularities in the spectra of molecules forming the intermolecular hydrogen bond by the predissociation effect</p> <p>B. I. Stepanov (State Optical Inst., Leningrad) <i>Nature</i> 157, 808 (1946), cf. C.I. 40, 2760. G. M. Perry</p> <p>Piroda,</p> <p>3</p>																									
<p>ASB-3LA METALLURGICAL LITERATURE CLASSIFICATION</p>																									

STEPANOV, B. I.

USSR/Physics
Spectra, Band
Molecular Structures

Jul/Aug 1947

"Approximate Method of Calculating the Fluctuation
Frequency of Complex Molecules," B. I. Stepanov, 6 pp

SSSR
"Iz. Ak. Nauk, Ser. Fiz", Vol XI, No 4

On the basis of the method developed by El'yashevich
and Stepanov for calculating the fluctuation frequency
of molecules, the author evolves a method of approxi-
mating the fluctuation frequency of complex molecules.
The basic method was developed for molecules of the
first matrix. If this same method were applied to
molecules from a 50-stage compound, however, one would
have to conduct some 250,000 operations. Submitted at
the State Optical Institute. 28782

ca

Theory of the optical sensitization of photographic emulsions. B. I. Stepanov and P. V. Meklyar (State Optical Inst., Leningrad). *J. Phys. Chem.* (U.S.S.R.) 21, 15-24(1947)(in Russian); cf. C.A. 41, 8037c.—The addnl. energy required to lift an electron of AgBr into a cond. band, when a AgBr emulsion is illuminated with long-wave light, is supplied by the vibrational energy of the sensitizing dye. The original state of the dye is immediately restored at the expense of the heat energy of the system; this accounts for the possibility of one mol. of dye causing formation of many Ag atoms. From the dependence of the sensitivity of the sensitized emulsion on the wave length, the no. of degrees of freedom involved in the transfer of energy to AgBr is calcd. to be about 30 for cyanine dyes. The theory explains 9 essential features of sensitization. J. J. Bikerman

Zhm. Fiz. Khim.

STEPANOV, B. I.

USSR/Spectrum Analysis
Pentane

Feb 1947

"A Theory of Vibrational Spectra of Polyatomic
Molecules, V," B. Stepanov, 24 pp

"Acta Physicochimica" Vol XXII, No 2

Calculation and interpretation of the spectra of
normal hydrocarbons, the calculation of frequencies
of the normal pentane molecule possessing 45° free-
dom, the interpretation of spectra of all other
normal paraffin hydrocarbons, the treatment of the
rotational isomerism of molecules of that type, and
proof of the existence of a rotational isomer of
lower symmetry for normal butane.

9T25

also in Dokl. AN SSSR. Vol. 22, No. 2, p. 238, 1947

STEPANOV, B. I.

Author: Vol'kenstein, M. V., ^{Yel'yashevik,} El'iashevich, M. A., Stepanov, B. I.

Title: The vibration of molecules. (Kolebaniia molekul.) 440 p.

City: Moscow

Publisher: State Printing House of Technical and Theoretical Literature.

Date: 1949

Available: Library of Congress

Source: Monthly List of Russian Accessions, Vol. 3, No. 3, Page 164

Call No: QC 173.V815

Subject: Molecular dynamics.

CA

Infrared spectra of uranyl salts. A. N. Sevchenko and B. I. Stepanyuk, *Zhur. Eksp. Teor. Fiz.* **10**, 1113-20 (1949). Defns. of absorption made on fine powders of $\text{UO}_2\text{SO}_4 \cdot 3\text{H}_2\text{O}$ (I), $\text{K}_2\text{UO}_2(\text{SO}_4)_2 \cdot 2\text{H}_2\text{O}$ (II), $\text{UO}_2(\text{AcO})_2 \cdot 7\text{H}_2\text{O}$ (III), and $\text{UO}_2(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$, held between fluorite plates transparent up to 15μ , or between crystal plates transparent up to 15μ , in the range $6\text{-}12 \mu$, led to findings and conclusions at variance with those of Crain and Wu (C.A. **33**, 2413). Pertinence of the observed absorption peaks to the UO_2^{++} ion, not to the anion, was ascertained by comparison with absorption spectra of H_2SO_4 , K_2SO_4 , and CuSO_4 in the same region. The observed frequencies (in cm^{-1}) and assignments are: I 830 (ν_1), 913 (ν_1), 990 ($5\nu_1$), 1130 ($\nu_1 + \nu_2$), 1204 ($6\nu_1$), 1429 ($7\nu_1$), $\nu_1 + 3\nu_2$, 873; II 909 (ν_1), $6\nu_1$, $\nu_1 + 2\nu_2$, 1429 ($7\nu_1$), $\nu_1 + 3\nu_2$, 873; III 990 ($5\nu_1$), 1030 ($\nu_1 + \nu_2$), 1130 ($\nu_1 + \nu_2$), 1204 ($6\nu_1$), $\nu_1 + 2\nu_2$, 1429 ($7\nu_1$), $\nu_1 + 3\nu_2$, 1515 ($2\nu_1$); IV 935 (ν_1), 1031 ($\nu_1 + \nu_2$), 1310 ($\nu_1 + 3\nu_2$), 873; V 935 (ν_1), 1515 ($2\nu_1$). These frequencies are consistent with the fundamental vibrations $\nu_1 = 830$, $\nu_2 = 300$, $\nu_3 = 920 \text{ cm}^{-1}$. The very intense frequency 873 in I (877 in III) remains unassigned, and its absence in II unexplained. The high intensity of 990 ($5\nu_1$) is surprising for so high a harmonic. The assignments of 1204 and of 1429 are ambiguous. On the basis of the assignments given, the UO_2^{++} and I cannot possibly have a linear shape, on account of the frequencies 830, 1130, and 1204, which are forbidden in a linear model; consequently, UO_2^{++} in I, and also in II, is bent. Of the frequencies observed in III, only 1515 is forbidden

for the linear shape; the remaining frequencies are allowed, and frequencies observed in I and II, which are forbidden for the linear model, are wholly absent. Consequently, in III, the UO_2^{++} ion must be nearly linear. Possibly, the assignment of 1515 to $\nu_1 + 3\nu_2$ is wrong and should be replaced by $\nu_1 + 3\nu_2$, with the deviation from the calc'd. value due either to Fermi resonance with $7\nu_1$ or to anharmonicity. By analogous considerations, UO_2^{++} in IV appears to be nearly linear. Dehydration of I by heating 6 hrs. at 300° does not alter the positions of the absorption maxima, but it does alter somewhat their relative intensities, and, moreover, gives rise to a new frequency at 1030 cm^{-1} ($\nu_1 + \nu_2$) which is normally present in hydrated II and IV. Synthesized anhyd. UO_2SO_4 has a spectrum very much different from both I and dehydrated I, and it practically undergoes no change in contact with normally humid air. The usual bands at 10.1, 8.2, and 7.0μ , (990, 1204, and 1420 cm^{-1}) are either absent or very weak; if the latter two are interpreted as harmonics $6\nu_1$ and $7\nu_1$, rather than as combinations $\nu_1 + 2\nu_2$ and $\nu_1 + 3\nu_2$, this may mean that high harmonics are linked with the presence of crystal. H_2O , or that H_2O mol. tightly bound with the UO_2^{++} ion increase its dipole moment for harmonics of ν_1 . The spectrum of anhyd. UO_2SO_4 shows also the $1030 (\nu_1 + \nu_2)$ band, absent in I. The closeness of the band between H_2O and the UO_2^{++} ion is further indicated by the absence, in I, of the 6μ absorption band of H_2O . That band reappears in initially anhyd. UO_2SO_4 after it has been exposed to moisture, and belongs, evidently, to hygroscopically condensed H_2O . In contrast to UO_2SO_4 , the spectrum of dehydrated IV

changes with the duration of exposure to moist air. Synthesized $\text{UO}_2(\text{NO}_3)_2$ with 0, 1, 2, 3, and 6H₂O, shows the same frequencies, but 1300 (γ_2) is absent in the prepn with 0, 1, and 2H₂O, is weak in the salt with 3H₂O, and fairly intense only in IV (with 6H₂O). This, again, confirms that crystn. H₂O facilitates the appearance of high harmonics. On the other hand, the shape of the UO_2^{++} ion is little affected by the crystn. H₂O, i.e. by the crystal lattice, which affects only the relative intensities. In contrast to the infrared spectrum, the fluorescence spectrum of UO_2^{++} salts is strongly dependent on the crystn. H₂O content, which affects not only the relative intensities but also the vibrational structure, i.e. the vibrational frequencies. This contradiction can only be taken to indicate that the amt. of crystn. H₂O and the lattice structure, while it does not significantly affect the vibrations assocd. with the lower electronic level, does have a decisive effect on the vibrational structure of the upper electronic level.

N. Thom

vibrational spectra of complex molecules and their ap-
plication to spectral analysis. B. I. Stepanov. Vestnik
Leningrad. Univ. 5, No. 3, 19-25 (1967). Review.
G. M.

STEPANOV, B. I., VOLKENSHTEYN, M. V. and YEL'YASHEVICH, M. A.

"Oscillations of Molecules," Moscow-Leningrad State Tech. Press, 1949. Reviewed
by V. M. Chulanovskiy, Sov. Kniga, No.10, 1950

STEPANOV, B. I.

PA 169T98

USSR/Physics - New Techniques
Light

Oct 50

"Determining the Duration of the Excited Oscillatory State With the Aid of M. L. Veyngerov's Spectrophone," B. I. Stepanov, O. P. Glirin.

"Zhur Eksper 1 Teoret Fiz" Vol XX, No 10, pp 947-955

Abstr.

Investigates processes occurring in the chamber of Veyngerov's spectrophone. Determines law governing time variation of temperature during pulsating illumination. Obtain mathematical

169T98

USSR/Physics - New Techniques
(Contd)

Oct 50

expression connecting quantities measured experimentally with duration of excited oscillatory state of molecule. Submitted 9 Mar 50.

169T98

1ST AND 2ND ORDERS																										3RD AND 4TH ORDERS																									
PROCESSES AND PROPERTIES INDEX																										COMMON VARIANTS INDEX																									
<p>4128</p> <p>EFFECT OF WATER OF CRYSTALLIZATION ON THE FLUORESCENCE SPECTRUM OF URANYL NITRATE.</p> <p>PART II. A. N. Sevchenko and B. I. Stepanov. Zhur. Khim. i Teor. Fiz. 21, 212-19(1951) Feb. (In Russian)</p> <p>Part I of this work appeared in Zhur. Khim. i Teor. Fiz. 21, 204(1951). Changes in the number of molecules of water of crystallization in uranyl nitrates are accompanied by considerable changes in the frequency both of the symmetrical valency oscillations of the UO_2^{++} ion in the lattice and of the electronic transitions. The fine structure of the spectrum, as observed at low temperature, is determined essentially by transitions between energy levels of the crystal lattice, only a few lines being due to transitions between electronic-oscillation levels of the uranyl ion.</p> <p>(auth)</p>																																																			
<p>ASD-SLA METALLURGICAL LITERATURE CLASSIFICATION</p>																																																			

68

Nature of the elementary processes of absorption and fluorescence of many compounds. II. I. Stepanov, *Zhur. Ekspl. Teoret. Fiz.* 21, 1181-7 (1951). An attempt is made to resolve the contradiction between the order of magnitude of the life of an excited state of an elec. dipole, 10^{-8} sec., and the exptl. order of magnitude, 10^{-4} sec., of the excited state in UO_2 salts. The proposed resolution of this conflict is based on the assumption that, inasmuch as electronic excitation of UO_2^{2+} in a crystal lattice is necessarily accompanied by a change of the positions of the atoms within the ion, it must also produce a deformation of the surrounding lattice. The total excitation energy is thus composed of the excitation energy proper of the electron cloud in the UO_2^{2+} , and of the energy of deformation of the lattice. The variation of the latter part in different UO_2 salts appears from the data of Samoilov (C.A. 43, 4136d), according to which the electronic excitation energy varies between different salts by as much as 800 cm.⁻¹. The same assumption is further corroborated by Samoilov's (loc. cit.) data showing differences of the vibration frequencies in different UO_2 salts, by Sevchenko and Stepanov's (C.A. 44, 4782i) proof that the very shape of the UO_2^{2+} may be different

(linear or bent) in different salts, and S. and S. (C.A. 46, 2077) observations of changes of the fluorescence spectrum depending on the no. H_2O mols. of crystal. The influence of the surrounding medium manifests itself further in the considerable broadening of the emission lines of UO_2 salts in solution and in glasses. The life τ of the excited state is inversely proportional to the probability p of the electronic transition, which, for dipole emission, can be written $p = \rho_0 \int |\psi_i \psi_f|^2 d\tau$, where ρ_0 is the transition probability in the absence of lattice deformation, and the integral includes the initial and final-state wave functions of the lattice; from the exptl. facts it must be concluded that the value of this integral is of the order of 10^{-9} sec. The long-lived emission of UO_2 salts, detected by Sverdlov and Sevchenko (C.A. 43, 407d) must be attributed to UO_2^{2+} , which, on excitation, causes a particularly strong deformation of the lattice and for which the value of the integral is of the order of 10^{-4} , hence p of the order of unity. A serious objection against this assumption is the fact that no indication of a

over

similar interaction with the lattice is found in solid salts other than of uranyl.
 Width of spectral lines of uranyl salts and its temperature dependence. B. I. Stepanov. *Zhur. Eksp. Teor. Fiz.* 21, 1184-83(1951). Between the temp. of liquid He and room temp., there is a gradual broadening of the emission lines of UO_2 salts, ending in complete disappearance of the fine structure. By the principle of indeterminacy, the width ΔE of a level and the life τ of the state are related by $\Delta E \tau = 1/c$. The absorption act can be followed by 5 types of transitions: (1) emission of light accompanied by transition of the UO_2^{2+} to the electronic ground state, (2) conversion of the electronic energy of the ion to intramolecular vibration energy, (3) conversion of intramolecular lattice vibration energy, (4) redistribution of internal lattice vibration energy over the whole lattice, (5) transfer of the electronic excitation energy to other UO_2^{2+} . If the respective probabilities of these processes are designated by a_1 with the corresponding subscripts, the width of the given nonstationary state of the crystal is $\Delta E = (a_1 + a_2 + a_3 + a_4 + a_5)/c$. From expl. data, the value of a_1 is known to be of the order of 10^4 sec.^{-1} ; if that process alone were detd. for the width of the level, one should have $\Delta E = 10^{-4} \text{ cm.}^{-1}$. Consequently, the emission line width cannot be detd. by process (1). From data on temp. quenching of the fluorescence of UO_2 salts, the effect of process (2) can be at most of the order $\Delta E = 10^{-6} \text{ cm.}^{-1}$. That the probability of process (3) is undoubtedly higher than the probabilities of the foregoing 2

processes, follows from the independence of the spectrum and quantum yield of the fluorescence of the wave length of the exciting radiation, which indicates emission by transition from only one or, at higher temps., two vibrational levels, and, consequently, a large extent of conversion of vibration energy of the ion into vibration energy of the lattice. From the line width at the temp. of liquid He, a_3 can be estd. to $\sim 10^{-11} \text{ sec.}^{-1}$; a fast increase of that probability with rising temp. is plausible, but is insufficient to account for the large broadening of the 1st group of lines. Process (4), consisting in a propagation of the perturbation which arises in the neighborhood of one UO_2^{2+} , throughout the lattice with the velocity of sound, results in a spread of $10^{-10} \text{ sec.}^{-1}$, i.e., the life of a local perturbation is of the order of 10^{-10} sec. , as $a_4 \sim 10^{10} \text{ sec.}^{-1}$, and the corresponding $\Delta E \approx 350 \text{ cm.}^{-1}$, consistent with the expl. emission band width of UO_2 salts at room temp. This process is absent at lower temps. on account of the smallness of the amplitudes. The existence of process (5) is indicated by the depolarization of the emission of uranyl glasses at advanced stages of the decay (Sevchenko, *C.A.B.* 44, 538(7)). However, the effect of that migration of the electronic excitation energy from one UO_2^{2+} to another, on the line width, is insignificant. The decisive factor responsible for the broadening of the emission lines of UO_2 salts is the redistribution of the lattice vibration energy. Processes linked with an isolated UO_2^{2+} are incapable of accounting for that broadening.

STEPANOV, B. I.

PA 197T100

USSR/Nuclear Physics - Crystallography

Oct 51

"Width of Spectral Lines of Uranyl Salts and Its
Dependence on Temperature," B. I. Stepanov

"Zhur Eksper i Teoret Fiz" Vol XXI, No 10, pp
1158-1163

Studies effect of various transition processes and
energy propagation in uranyl salts on width of
spectral lines. Shows that most important is ef-
fect of distribution of oscillatory energy in
cryst lattice. Hence spectrum type is connected
with change in cryst lattice. Stepanov acknowl-
edges A. N. Sevchenko's advice (cf. Sevchenko and
Stepanov, *ibid.* 21, 12, 1951). Submitted 29 Dec 50.

LC

197T100

STEPANOV, B. I.

3

Vibration energy and luminescence of complex molecules.
 1. B. S. Reprent. *Lipetsk. Fiz. Zh.* 41, 382-402 (1951).—The distribution of energy in and the spectra of a complex org. mol., the dependence of the efficiency and the duration of fluorescence on the vibration energy, and other features of the org. mol. are reviewed. Most of the work was done on solids, because fluorescence expts. in gases are difficult to make at const. pressure; however the investigation of the fluorescence of vapors, whenever they do not decomp. on evapu., gives the possibility of studying many aspects impossible to obtain in soli. Complex mols. are mols. in which the probability of energy redistribution is greater than the reciprocal of the lifetime of the excited state. The spectra are line spectra in simple mols., diffused in semi-complex, and continuous in complex mols. Emission and absorption spectra have mirror symmetry. The quantum output is larger in soli. than in vapors. The lifetime of the excited state and the quenching by other gases are described as well as the increase in fluorescence by foreign gases and the stabilization of fluorescence by collisions by transfer of the vibration energy, characterized by an "accommodation coeff." (cf. *C.A.* 45, 5518h). II. B. I. Stepanov. *Ibid.* 402-25.—A theory of localization of the vibration energy on certain degrees of freedom is developed. Owing to a continuous change in localization and a redistribution of vibration energy of the mol. on different degrees of freedom, continuous spectra are formed. Thus classical statistics can be applied to such mols. which can have their own specific temp. From such considerations the lifetime and the distribution function of excited states are derived, and the decay time of fluorescence can be calcd. both for vapors and for solids. The quantum output and the temp. quenching of fluorescence are also derived from the distribution function (cf. *C.A.* 46, 8970h). 31 references.

[Handwritten signature] 1/29/54

S. Pakawer

STEPANOV, B. I.

USSR/Physics - Oscillatory Spectra 1 Feb 52

"Distribution of Intensity in the Oscillatory Spectra of Linear Chains,"
L. I. Vidro, B. I. Stepanov

"Dokl⁸¹ Ak. Nauk SSSR" Vol LXXXII, No 4, pp 557-560, 1957

Calculates the intensities of infrared and combinational lines for 2 simplest models - linear chains, using the valent-optical scheme of M. V. Vol'kenshteyn and M. A. Yel'yaskevich. Considers a simple linear chain consisting of $2n+1$ identical bonds: $o-o-...-o-o$. Acknowledges the helpful assistance of Prof M. V. Vol'kenshteyn. Submitted by Acad A. N. Terenin 4 Dec 51.

PA 213T112

STEPANOV, B.I.

Sevchenko, A.N.)
Stepanov, B.I.)

Title of work
"Investigation of the Luminescence
of Uranyl Compounds"

Organization
Academy of Sciences Belorus-
sian SSR

STEPANOV, B.I.

V Kirchhoff's law. B. I. Stepanov. Vestn Akad. Nauk i
Belarus. S.S.R. 1955, No. 3, 118-23.—The effect of the
presence of forced radiation on the formulation of Kirch-
hoff's law of the equil. between the radiation and a sub-
stance being irradiated is derived. The actual expression of
Kirchhoff's law is $(W_0/W_1)(a_0/W_1 - 1) = U_0 = (8\pi^5
h^3)/V^2 \cdot 1/(e^{h\nu/kT} - 1)$ instead of the conventional formula,
 $W_0/a_0 = U_0$, $W_0 = W_1(8\pi^5 h^3)/V^2$, and $a_0 = W_1 e^{h\nu/kT}$,
resp., where W_0 = potency of an isotopic substance to emit
radiation, W_1 = potency of the forced radiation, a_0 =
ability of the substance to absorb radiation, U_0 = d. of the
radiation energy, h = Planck's const., V = velocity of the
radiation distribution in a given medium, ν = frequency of
the radiation, k = Boltzmann const., and T = abs. temp.
E. Wierbicki

Ant
MST

STEPANOV, B. I.

B-4

USSR/ Physical Chemistry - Molecule. Chemical bond

Abs Jour : Referat Zhur - Khimiya, No 4, 1957, 10847

Author : Stepanov B.I.

Inst : Academy of Sciences Belorussian SSR

Title : Probability of Electronic-Oscillation Transitions and Laws of
Fluorescence Attenuation of Complex Molecules

Orig Pub : Vestsi AN BSSR, 1954, No 5, 60-69 (Belorussian); Izv. AN BSSR, 1954,
No 5, 65-74

Abstract : Specific features of emission and absorption of light by complex molecules are connected with the occurrence of redistribution of oscillation energy between different degrees of freedom. Optical properties of molecules are strongly affected by energy exchange with surrounding medium. In this paper are investigated characteristics of probability of transitions with emission of light in complex molecules. It is shown that due to energy exchange with surrounding medium, probability values of all optical transitions are averaged over all oscillation levels of initial electronic state. This explains the rigorously exponential law of fluorescence attenuation of solutions of complex molecules. This law is found to be the same for all frequencies

Card 1/2

STEPANOV, B.I.

GIRIN, O.P.; ZHIDKOVA, Z.V.; ~~STEPANOV, B.I.~~ IVANOV, A.P.; TOPORETS, A.S.

Determination of the true absorption spectra of scattering colored
objects by their diffuse reflection spectra. Izv. AN SSSR Ser.fz.
18 no.6:728-729 N-D '54. (MLRA 8:3)

(Absorption spectra) (Light---Scattering)

STEPANOV R. I.

USSR

535,361.2

6826. Reflection spectra of coloured light-scattering objects. II. O. P. GIREN AND B. I. STEPANOV. *Zh. khim. teor. Fiz.*, 27, No. 4(10), 467-76 (1954) In Russian.

Reviews theoretical work so far available, based mainly on papers of Bodo [Abstr. 8802 (1952)] Gurevich [Trudy GOI (Gosudarstvennogo Opticheskogo Instituta) 6, No. 57 (1931)] and Gershun [*ibid.*, 11, No. 99 (1936)], develops a new, more general, expression for the coefficient of reflection, and explains the limits of applicability of Gurevich's formula (which contains no allowance for the size of particles). At the same time the dependence is studied of reflection spectra on the dimensions of the particles and the properties of the connective medium. It is shown that the spectrum of diffuse reflection may widely differ from the absorption spectrum of the substance in bulk.

F. LACHMAN

USSR/ Physics - quantum mechanics

Card 1/1 Pub. 22 - 23/63

Authors : Stepanov, B.I.; active member of the Acad. of Scs. of the ^BUSSR

Title : On the quantum output of fluorescence

Periodical : Dok. AN SSSR 99/6, 971-974, Dec 21, 1954

Abstract : A more precise formula for computation of so-called "quantum output of fluorescence" (the term is defined) is presented. The formula enables the quantum output of fluorescence to be computed by taking into account the dependence of the light on the thermal effect; the formula is expressed as follows:

$$B = \frac{1 + \frac{d_0(1-e^{-h\nu/kT})}{A(1+S/\nu_0)}}{1 + \frac{d_0}{A}(1-e^{-h\nu/kT})}$$

and the symbols are explained. The quantum output is always less than unit, it equals 1 only when $S=0$ or $\frac{d_0}{A} \ll 1$. Two USSR references (1951). Diagram

Institution: Physico-technical Institute of the Acad. of Scs. of the USSR

Submitted:

~~STEPANOV~~, B.I.; SEVCHENKO, A.N., redaktor; ALEKSANDROVICH, Kh., tekhnicheskiy
redaktor

[Luminescence of complex molecules] Liuminestsentsiia slozhnykh
molekul. Minsk, Izd-vo Akademii nauk BSSR, Pt.1. 1955. 325 p.
(Luminescence) (Molecules) (MLRA 9:9)

USSR/Physics - Luminescence

Stepanov, B.I.

Card 1/1

Pub 146-24/25

Author : Alentsev, M. N.; Antonov-Romanovskiy, V. T.; Stepanov, B. I.; Fok, N. V.

Title : Yield of resonance fluorescence of atoms

Periodical : Zhur. eksp. i teor. fiz. 28, 253-254, February 1955

Abstract : B. I. Stepanov (DAN SSSR, 99, 971, 1954) studied the statistical interaction of radiation and system consisting of atoms possessing two energy levels, and showed that the radiation output varies in dependence upon the density of the exciting radiation (this conclusion refers to the total radiation). The authors apply the proposed method to the calculation of the luminescence output of a similar system, e.g. the resonance fluorescence of atoms. They obtain an expression for the quantum output of fluorescence.

Institution: Physics Institute im. P. N. Lebedev, Academy of Sciences USSR
Physics Institute, Academy of Sciences Belorussian SSR

Submitted : November 25, 1954

STEPANOV, S. I.

308 /

535.345 : 535.231.4

4327. ABSORPTION AND EMISSION OF LIGHT BY A GREY
SUBSTANCE. B.I. Stepanov.

Zh. éksper. teor. fiz., Vol. 28, No. 5, 559-66 (1955). In 62.
Russian. English translation in Soviet Physics JETP (New
York), Vol. 1, No. 3, 446-51 (Nov., 1955).

A substance is defined as grey if its "absorption capacity"
(ratio of energy absorbed to radiation density) is the same for
all frequencies, and if its emissivity is proportional to that of
a black body. The thermodynamical properties of such a sub-
stance are discussed. It is claimed that the results obtained
are relevant to absorption and emission of light by complex
molecules.

L. Pincherle

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Paw
88x

STEPANOV, B.I.

K-5

USSR/Optics - Physical Optics.

Abs Jour : Referat Zhur - Fizika, No 3, 1957, 7748

Author : Antonov - Romanovskiy, V.V., Stepanov, B.I., Fok, M.V.,
Khamalyuk, A.P.

Inst : Physics Institute, Academy of Sciences, USSR., Physico-
Technical Institute of the Academy of Sciences of the
Byelorussian.

Title : Luminescence Yield From a System with Three Energy Levels

Orig Pub : Dokl. AN SSSR, 1955, 105, No 1, 50-53

Abstract : The luminescence yield of a system with three energy levels is calculated and it permits resolving the fundamental problem of whether the value of the energy yield Φ can exceed unity. Attempts found in the literature of a thermodynamic proof of the impossibility of $\Phi > 1$ are not satisfactory. The energy yield of luminescence of a system with three levels (Pringsheim model) (Pringsheim, P., Journal of Physics, 1949, 10, 495) is calculated

Card 1/2

- 43 -

STEPANOV, B.I.

B-4

USSR/ Physical Chemistry - Molecule. Chemical bond

Abs Jour : Referat Zhur - Khimiya, No 4, 1957, 10846

Author : Stepanov B.I., Samson A.M.

Inst : Academy of Sciences Belorussian SSR

Title : Dependence of Probability of Optical Transitions on Transition Frequency and Oscillation Energy Supply of Complex Molecule

Orig Pub : Vestsi AN BSSR, Ser. fiz. -tekhn. n., Izv. AN BSSR, Ser. fiz. -tekhn. n., 1956, Nol, 5-14 (Belorussian; Russian summary)

Abstract : On the basis of the model of unidimensional, classical harmonic oscillator for a complex molecule of group 1, an expression has been derived for the probability of transitions from different oscillation levels of lower electronic state to different oscillation levels of upper electronic state. In the derivation there is taken into account the change in coordinate and impulse in the process of electronic oscillation transition. Investigation of the derived formula in the case of invariable impulse is effected by numerical integration. It is shown that probability of the transitions depend on transition frequency and also on oscillation energy supply of the initial level. Elucidated are the reasons of slight dependence of absorp-

Card 1/2

STEPANOV, I. I.

USSR / Physical Chemistry. Molecule. Chemical Bond.

B-4

Abs Jour : Ref Zhur - Khimiya, No 8, 1957, 25747

Author : B.I. Stepanov

Inst : Academy of Sciences of White Russian SSR.

Title : Spectroscopy in Science and Engineering

Orig Pub : Izv. AN BSSR, Ser. fiz.-tekhn. n., 1956, No 2, 5-14

Abstract : Report to the yearly meeting of the Academy of Sciences of
White Russian SSR in 1956.

Card : 1/1

- 8 -

STEPANOV B.I.

K-6

RUMANIA/Optics - Luminescence

Abs Jour : Ref Zhur - Fizika, No 2, 1958, No 4524

Author : Stepanov, B.I.

Inst : Not Given

Title : The Vavilov Law

Orig Pub : An. Rom.-Sov. Ser. mat.-fiz., 1956, 10, No 4, 47-74

Abstract : See Referat Zhur Fizika, 1957, No 11, 29099

Card : 1/1

STEPANOV

USSR / Physical Chemistry. Molecule. Chemical Bond.

B-4

Abs Jour : Ref Zhur - Khimiya, No 8, 1957, 25773

Author : B.I. Stepanov.

Inst : Academy of Sciences of USSR

Title : Contour of Absorption and Radiation Bands of Complex Molecules.

Orig Pub : Izv. AN SSSR, ser. fiz., 1956, 20, No 4, 458-463

Abstract : The computation of the shape of absorption and light radiation bands of complex molecules, and the alteration of these bands with the temperature and parameters characterizing the molecule model is carried out; the model of the monomeric classical harmonic vibrator was selected as such molecule model, and it was assumed that the model preserved the quantum

APPROVED FOR RELEASE: 08/25/2000 CIA-RDP86-00513R001653130008-4
gy. Taking into consideration the change of nuclear coordinates at the transition of the molecule from one state into

Card : 1/2

- 25 -

K

USSR / Optics

Stepanov, B.I.

Abs Jour: Referat Zhur-Fizika, 1957, 1957, No 4, 10404

Author : Stepanov, B.I.

Inst : Not Given

Title : Quantum Yield of Luminescence of Complex Molecules.

Orig Pub: Izv. AN SSSR, ser. fiz., 1956, 20, No 4, 493-501

Abstract: Paper delivered at the Fourth Conference on Luminescence. The survey touches on the following problems: account of the background of thermal radiation in the calculation of the quantum yields of luminescence and emission, effective vibrational energy on the luminescence of complicated molecules in solutions and vapors, quenching of luminescence of the first and second kind, possibility of realizing a quantum yield greater than unity, existence of negative luminescence, and reduction in quantum yield of luminescence in the anti-Stokes excitation. A new expression is obtained for the dependence of the quantum yield on

Card : 1/2

K

USSR / Optics

Abs Jour: Referat Zhur-Fizika, 1957, No 4, 10404

the frequency of the exciting light at excitation frequency less than electron frequency. As a result of calculations, based on the step by step account of the exciting absorption, it is established that the dependence of the quantum yield on the excitation frequency is the same as the dependence of the coefficient of absorption on the absorption frequency.

Card : 2/2

USSR/ Physics - Luminescence phenomenon

Card 1/2 Pub. 118 - 1/7

Authors : Stepanov, B. I.

Title : Vavilov's law

Periodical : Usp. Fiz. nauk, 58/1, 3-36, Jan 1956

Abstract : In connection with the 5-th anniversary of the death of Mr. Vavilov, physicist and academician, his work on the luminescence phenomenon is discussed. His definition of luminescence is considered as the most correct. His law dealing with the quantum output of luminescence is also considered as correct (experimentally proved) and important in the theory of luminescence. This law is stated as follows: the quantum output of luminescence (fluorescence) does not depend on the frequency of the exciting light, while they (the frequencies of exciting light or radiation) are within the range of Stocke's spectral band, but it

Institution :

Submitted :

Card 2/2 Pub. 118 - 1/7

Periodical : Usn. Fiz. nauk, 58/1, 3-36, Jan 1956

Abstract : (the quantum output) falls rapidly as soon as the frequencies of exciting light or radiation reach the maximum luminescence band. However, there is an indication that the mentioned law can be applied only to condensed systems. Forty-seven references: 1 USA, 1 Swiss, 3 Gern., 42 USSR (1888-1955). Graphs; diagrams; photograph.

STEPANOV, B. I.

SOV/1899

16(1); 24(4,5)

PHASE I BOOK EXPLOITATION

Akademiya nauk Belorusskoy SSR. Institut fiziki i matematiki

Trudy, vyp. 2. (Transactions of the Institute of Physics and Mathematics, Belorussian SSSR Academy of Sciences, Nr 2) Minsk, 1957. 283 p. Errata slip inserted. 750 copies printed.

Ed.: B. I. Stepanov, Academician, BSSR Academy of Sciences; Ed. of Publishing House: L. Marike; Tech. Ed.: I. Volekhanovich.

PURPOSE: This book is intended for mathematicians, physicists, and graduate students in mathematics and physics.

COVERAGE: This book contains a series of articles on recent contributions by members of the Institut fiziki i matematiki (Institute of Physics and Mathematics) of the Academy of Sciences, BSSR, in the fields of radiation, luminescence, optics, and spectroscopy and on the applications to physics of analysis, tensor analysis, linear groups, theory of adjustments, and differential equations. The

Card 1/5

80V/1899

Transactions of the Institute (Cont.)

first article contains a brief account of the work of the Institute, including names of scientists and mathematicians connected with it, facilities, scientific accomplishments, and fields of interest.

TABLE OF CONTENTS:

The Institute of Physics and Mathematics at the Time of the 40th Anniversary of the Great October Socialist Revolution	1
Gurinovitch, G. P., and A. N. Sevchenko, Determination of the Nature of an Elementary Emitter for the Case When the Directions of Absorption and Radiation Oscillators Do Not Coincide	3
Stepanov, B. I. and Yu. I. Chekalinskaya, Luminescence of Scattering Media I.	19
Chekalinskaya, Yu. I. Luminescence of Scattering Media II	38
Apanasevich, P. A. Transformation of Light by an Atom	55

Card 2/5

SOV/1899

Transactions of the Institute (Cont.)

Godnev, T.N., R. V. Yefremova, and L. A. Kravtsov. On the Spectral Properties of Chlorophyll and Chlorophyllide Complexes With Protein and Certain Other Compounds	85
Kripskiy, A. M. Spectroscopic Interaction of Sulphur and Iron in Sources of Light for Spectral Analysis	93
Yankovskiy, A. A. On the Role of Electric Parameters of a Discharge Contour With an Excitation of the Spectrum by a Low-voltage Impuse Discharge	110
Prima, A. M. Calculating the Oscillating Spectra of Silicates	124
Volod'ko, L. V. Electronic Spectra of Solutions of Uranium Salts	174
Stepanov, B.I., and A. P. Prishivalko. On the Theory of Dispersion Light Filters	189
Prishivalko, A. P. The Filtration of Light by Layers of Absorbent Dust	206

Card 3/5

Transactions of the Institute (Cont.)

SOV/1899

Borisevich, N. A., Ya.S. Khvashchevskaya, and I.F. Iaptsevich. Dispersion Filters for the Infrared Region of the Spectrum	214
Bokut', B. V. Surface Energy of a System in the Neighborhood of an Ideal Wall	224
Fedorov, F. I. On Certain Diadic Representations for Three-dimensional Tensors	230
Yerugin, N. P. Analytic Theory of Nonlinear Systems of Ordinary Differential Equations	235
Krylov, V. I. On the Proof of the Impossibility of Constructing a Quadrature Formula With Equal Coefficients and Number of Nodes Greater Than Nine	249
Suprunenko, D. A. Two Theorems on Reducible Nilpotent Linear Groups	255
Popov, V. V. (Deceased) Determination of the Weight of a Function of Adjusted Values Using Polygonal Adjustment Method	260

Card 4/5

Stepanov, B I

51-3-9/24

AUTHORS: Kazachenko, L.P. and Stepanov, B. I.

TITLE: Mirror symmetry and the shape of absorption and luminescent bands of complex molecules. (Zerkal'naya simmetriya i kontur polos pogloshcheniya i ispuskaniya slozhnykh molekul).

PERIODICAL: "Optika i Spektroskopiya" (Optics and Spectroscopy), 1957, Vol.2, No.3, pp.339-349 (U.S.S.R.)

ABSTRACT: V. L. Levshin (Zh. Fiz. Khimii, Vol.2, p.641, 1931) discovered mirror symmetry between the absorption and luminescence bands of complex molecules. Study of this symmetry yields information on the vibrational excited and ground levels as well as on the electronic transitions. D. I. Blokhintsev (Zh. Eksper. Teor. Fiz., Vol.9, p.459, 1939) showed that this symmetry can be studied correctly only when χ/ν_a (χ = the absorption coefficient, ν_a = the absorption frequency) and W/ν_l^4 (W = the luminescent radiated power, ν_l = the luminescence frequency) are plotted as ordinates against frequency. The authors apply Blokhintsev's analysis to a series of phthalimide vapours and solutions. They show, inter alia, that B.S. Neporent et al. (Doklady Akad. Nauk SSSR, Vol.92, p.927, 1953) and V.P. Klochkov (Zhurn. Fiz. Khimii, Vol.39, p.1432, 1955) are wrong in assigning mirror

Card 1/2

Mirror symmetry and the shape of absorption and luminescent bands of complex molecules. (Cont.) 51-3-9/24

symmetry on the frequency scale to the absorption and luminescent bands of 3-aminophthalimide and 3-methylamino-phthalimide which do not possess such symmetry. These and other errors of Neporent and Klochkov are due to the use of χ and W_l/ν_l as ordinates instead of χ/ν_l and W_l/ν_l^4 as suggested by Blokhintsev. The authors show that the division of molecules into two groups (as suggested by various workers), one with mirror symmetry on the frequency scale and the other with mirror symmetry on the wavelength scale, is quite unnecessary and unsupported by experimental data. The authors also derive relationships between the absorption and luminescent spectra in a form of a ratio W_l/χ , and between the luminescent and thermal radiated powers. These relationships are valid for condensed systems only.

Card 2/2 There are 5 figures, 2 tables and 14 references, 13 of which are Slavic).

SUBMITTED: June 4, 1956.

ASSOCIATION: Byelorussian State University. (Belorusskiy Gos. Universitet).

AVAILABLE:

51-1-1/18

AUTHOR: Stepanov, B. I.

TITLE: Effect of the Thermal Radiation Background on Spectroscopic Processes. (Vliyaniye fona teplovogo izlucheniya na spektroskopicheskiye protsessy.)

PERIODICAL: Optika i Spektroskopiya, 1957, Vol.III, Nr.1, pp.1-8. (USSR)

ABSTRACT: The usual apparatus for the study of absorption and luminescence (Fig.1) consists of a source of light a, sample holder b and receivers of radiation v and g. If the source temperature T_a is higher than the sample temperature T_b , then the energy in the positive direction (from the source to the sample) W_{ab} exceeds the energy flowing in the opposite direction W_{ba} . The difference $W = W_{ab} - W_{ba}$ is called the incident radiation power. It is often assumed that W_{ba} is negligible: this is not always true. The author discusses in general terms the effect of thermal

Card 1/3

51-1-1/18

Effect of the Thermal Radiation Background on Spectroscopic Processes.

radiation from the source, the receiver and the sample holder on results of spectrophotometric measurements. The author deals in detail with the particular case when the source temperature T_a is smaller than the sample temperature T_b , i.e. the case of "negative excitation". Negative luminescence, negative Rayleigh scattering and negative Raman scattering are discussed. The essential difference between positive and negative excitations lies in the fact that the positive radiation may be arbitrarily intense. The negative radiation has a maximum value equal to $U_0 c / 4 \pi$, where U_0 = equilibrium radiation density. Negative excitation is sometimes more useful than a positive one. This is so when, e.g., the sample is at a temperature of 6000°C, since there are no sources of light powerful enough to achieve positive excitation. From studies using negative excitation one can obtain the usual results: distribution of bands or lines in a spectrum, relative intensities, polarization, excited-state lifetime, quantum yields, etc. There are

Card 2/3

STEPANOV, B. I.

48-11-1/13

AUTHOR: Stepanov, B. I.

TITLE: Introduction (Vstupitel'noye slovo).

PERIODICAL: Izvestiya AN SSSR Seriya Fizicheskaya, 1957, Vol. 21, Nr 11, pp. 1471-1472 (USSR).

ABSTRACT: This issue is devoted to the 1st conference on the spectroscopy of light-dispersing media which was convened in Moscow on March 29-30, 1956, on the initiative of the Commission for Spectroscopy of AN USSR. This conference was attended by representatives of a series of scientific organisations from Moscow, Minsk, and Leningrad. The introduction gives a summarizing survey on the problems of the spectroscopy of dispersing media, which is a newly discovered line of spectroscopy. In most cases they just collect and systematize the experimental material for the time being. One of the fundamental problems of this branch of spectroscopy is the determination of the spectral relations and of the numerical values of absorption-coefficients and indice of refraction of dispersed substances. In dispersed media the variation of the spectrum can be correlated with a change of the rules of light-diffusion. Both the reflection- and transparency spectra of the dispersed objects depend not only on the optic constants of the element, but also on

Card 1/2

Introduction.

48-11-1/13

the size of the light-dispersing particles, of the index of refraction of the connecting medium, the relative content of absorbed substance and connecting medium, as well as of the thickness of the layer. By varying one of these parameters, or all of them together, the spectra and the absolute values of the coefficients of reflection and transparency can be substantially varied and the dye of the substance can be changed. Many important problems arise with the study of the luminescence of the powdery materials. Not only the re-absorption, but also the secondary luminescence should be taken into account in this case. The elaboration of these problems is only in the beginning. The phenomena occurring during the work with dispersion-light-filters are also within the field of this branch of spectroscopy. Their theory is almost not elaborated at present.

AVAILABLE: Library of Congress.

Card 2/2

STEPANOV, B. I.

48-11-3/13

AUTHOR: Stepanov, B. I.

TITLE: The Fundamental Problems of the Spectroscopy of Dispersing Media
(Osnovnyye problemy spektroskopii rasseivayushchikh sred).

PERIODICAL: Izvestiya AN SSSR Seriya Fizicheskaya, 1957, Vol. 21, Nr 11,
pp. 1485-1493 (USSR).

ABSTRACT: First are shown the fundamental tasks of the spectroscopy of dispersing objects. 1) Determination of the inner properties of the substance according to the transparency- and reflection spectra, i. e. determination of the coefficient of absorption of the same substance in none dispersed state. The refraction-index must be determined parallel with this. The true spectrum of luminescence must be determined with luminescing objects. 2) Calculation of the coefficients of both transparency and reflection, as well as of the intensity of luminescence of the whole layer for various wave lengths if the coefficients of absorption and the index of refraction of the element and of the connecting medium, the degree of dispersion, the thickness of the layer and the fundamental characteristics of luminescence are known. 3) Determination of the optic properties of the layer of the dispersed substance of optional thickness. - Subsequently a survey is given of the

Card 1/2